THE SCIENCE NEWS-LETTER

A Weekly Summary of Current Science

EDITED BY WATSON DAVIS

ISSUED BY
SCIENCE SERVICE
1115 Connecticut Avenue
WASHINGTON, D. C.

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SUBSCRIPTION: $5 A YEAR, POSTPAID

Vol. II, No. 103 Saturday, March 31, 1923

PROOF OF EINSTEIN'S THEORY COMES FROM WITHIN ATOM

The light from the interior of the atom, as well as the light from the distant stars, gives evidence in support of the Einstein theory of relativity according to Prof. A. Sommerfeld of Munich. Following his series of lectures at the Bureau of Standards in Washington, the German professor gave the results of his calculations of the orbits of the electrons in hydrogen and helium atoms and showed that the grouping of these lines in the spectra of these gases was in close conformity with the figures given by the Einstein formula.

According to the modern view of the internal structure of the atom there is a central nucleus of positive electricity around which revolve at high speed one or more negative electrons. These may move in circular or in elliptical orbits as do the planets around the sun. If the orbit is a circle the revolving electron moves at an even speed throughout its course. But if the orbit is an ellipse the electronsmust move faster when it is making the turn nearest to the central nucleus at the focus than when it is at the more distant end of the ellipse. This difference in speed would make no difference to the mass of the electron according to the old Newton theory for this assumed that mass was unalterable. But according to the new Einstein theory a particle moving at high speed is heavier than when moving slower, so the electron would vary in mass in different parts of its elliptical orbit and therefore the energy it gave off in the form of light would depend upon the shape as well as the major diameter of the orbit.

There are only a limited number of such orbits that an electron can pursue and in slipping from one of these to another a certain quantum of light is given off which may be recognized by its position in the spectrum. The light given off from the incandescent gases, hydrogen and helium, as well as the X-ray spectrum of heavy metals like platinum, show that the corpuscles making up the atom obey Einstein's law instead of Newton's.

Astronomical evidence on the Einstein theory is expected whenever Prof. W. W. Campbell, director of the Lick Observatory and president of the University of California, announces the results of his expedition to Australia last September to take photographs of the eclipse when visible. If the photographs show an outward displacement of the stars surrounding the darkened disk of the sun, it will prove that Einstein was right in predicting that a ray of star-light passing close to the sun would be drawn out of its course. For, according to Einstein, space about a heavy body like the sun is distorted so that light cannot travel straight; a point that Prof. Sommerfeld illustrated by putting his hand under the piano spread and puckering it up. A billiard ball, he said, would have difficulty in passing over such a hummock as light does in passing through a gravitational field. Space by itself does not exist but is produced by what is in it and the sort of space it is depends

upon the amount and distribution and motion of the particles of matter.

READING REFERENCES- Einstein, Albert. The meaning of relativity; four lectures at Princeton University May,1921. Princeton, Princeton University Press, 1923. Mills, John. Within the atom. New York., D. Van Nostrand Co., 1922. Slosson, Edwin E. Easy lessons in Einstein. New York, Harcourt, Brace and Co., 1920.

Dr. Edwin E. Slosson

CHATS ON SCIENCE

THE SUCCESS OF A FAILURE

"No," said the lumber dealer, "your boy is good for nothing in my business. In fact, he is the most miserable failure I have ever seen and will never amount to anything."

"Well," replied the disappointed father, "since Emil is too stupid to make a living in lumber I suppose I might as well let him go to college as he wants to."

So Emil Fischer went to Bonn University to study chemistry. Here he was recognized as one of the most brilliant and industrious students in the laboratory and by the time he was twenty-three he had discovered a key that unlocked one of the most mysterious processes of life. This key was a coal-tar compound known to chemists as "phenyl hydrazine". It was both fortunate and fatal to Fischer. It made him one of the most famous chemists in the world and it brought him disease and death. For the fumes of it are poisonous and constant working with it ruined his health.

But nothing could impair his energy or dampen his ardor. For after he got free from the lumber business and started on his own track, he pursued it for 45 years without interruption or diversion. As one of his colleagues said at the time of his death in 1919:

"A life is ended in which there was no failure, no let-up in restless activity, no long groping about for something to accomplish. After one quick, clear vision of the goal the path led straight to its accomplishment, a chain of brilliant successes."

How Prof. Fisbher himself looked at his life work is shown by these words;

"Still more enticing to some, among whom I include myself, is the hope to climb up out of the valleys to those passes seen afar off, which lead to vast and as yet unexplored countries."

The unexplored country that he had in view and ventured in was no less than the formative functions of vegetable and animal life. With the aid of phenyl hydrazine he was able to solve the secret of sugar. Not content with finding out how sugar may be made by the plant he learned to make it himself. He found it possible to produce in the laboratory many more kinds of sugar than can be discovered in nature. Finally, he worked out a process by which he could start with plain coal and water and build up a series of edible sugars.

Then Fischer tackled a still more difficult problem in nutrition, the constitution of the proteins. These form an essential part of our food since they contain the nitrogen necessary to all life. It used to be thought that the proteins, whether of vegetable origin, like the gluten of wheat, or of animal origin, like the casein of milk, were much alike and that it made little difference which of the many we got in our food. But Fischer showed that a protein molecule was made up of a long chain of carbon and nitrogen compounds and that the links were of very different kinds. Finally, he made a sort of artificial protein, what might be called a laboratory beefsteak, but whether it was good to eat or not could not be determined since there was so little of it and it cost so much. He spent $250 for the material alone, to say nothing of his time, in constructing this compound, so, as he said, "it has not yet made its appearance on the dining table."

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"Even when the students missed some of the Esperanto classes they did better in Esperanto than in Danish," said Dr. Ruckmick. A partial grading of students present at all classes showed the following numerical score: Esperanto, 58:540; Danish, 45.924. Although there was no examination in pronunciation, Dr. Ruckmick believes that the students found Esperanto easier to speak. More ground was covered in the Esperanto lessons and this made the examination in the artificial tongue harder, although no allowance for this was made in the ratings. The linguistic experiments are being continued this semester.

Danish was selected for comparison with Esperanto in the scientific tests, Dr. Ruckmick said, because it is a typical highly-inflected Teutonic language in which the students had practically no grounding.

The Wellesley tests are being followed with interest by the International Auxiliary Language Committee of the International Research Council, as well as the newly organized section on Linguistic Science of the American Association for the Advancement of Science.

MASTODONS AND MAMMOTHS ONCE PLENTIFUL IN NEW YORK

Mastodons and wooly mammoths were once as thick in New York State as the bison were on the western plains a century ago, according to Dr. Sherman C. Bishop, zoologist of the State Museum of New York. Although the mammoths were more closely related to the elephants, the only surviving members of the family, they were the first to become extinct and probably passed off the scene while the mastodons were still thriving.

Skeletons of mastodons, more or less complete, and some of them suitable for museum mounting, have been found in about 100 localities in the state, the last one at Temple Hill, Orange County, in 1921. The first was made in Columbia county, not far from Albany, in 1705.

These huge mammals are believed to have flourished about the end of the last glacial period, some 20,000 years ago. Their skeletons are found generally in the marsh lands of those early days.

READING REFERENCE- Neuville, Henri. On the extinction of the mammoth. Smithsonian Institution annual report 1919. Washington, 1921. Lucas, F. A. Animals of the past. New York. American Museum of Natural History, 1922. Hutchinson, H. N. Extinct monsters and creatures of other days; a popular account of some of the larger forms of

OXYGEN GLUTTONS MAKE GOOD ATHLETES

Possibilities of athletic records of an entirely new sort are disclosed by Dr. A. V. Hill, professor of physiology in the University of Manchester, England, who proposes competitive measurements of the oxygen-using qualities of athletes,. the man who absorbs most to get the prize. He also suggests tests of the amount of "credit" on oxygen which nature permits individual athletes.

Aside from the inherent strength of the muscles and the psychological quality of stamina, Dr. Hill believes the power of an athlete to depend largely upon his capacity to use oxygen quickly and upon the tolerance of his body for lactic acid, a waste product of muscular exertion which is rapidly oxidized upon the completion of the effort. This is measured by the amount of oxygen consumed immediately after the completion of the effort, the increased consumption being considered as the payment by nature of a "loan" made to the body during the period of severe exertion.

A professor in the University holds the record for oxygen consumption during exertion, having managed to utilize more than four liters, or a gallon, a minute while running vigorously. Dr. Hill calculates that to do this he had to pump all the blood in his body through his heart and lungs seven times in a minute. Another member of the faculty at the completion of violent exercise lasting 10 minutes, utilized in the next 10 minutes 10 liters of oxygen above the normal. This indicates according to Dr. Hill that he had about the maximum amount of lactic acid in his muscles or that his "line of credit" in oxygen was exceedingly good, his system putting up for a time with the lack of a great deal of it.

Dr. Hill surmises on the basis of these calculations that the maximum athletic records involving prolonged exertion may be calculated mathematically. For brief efforts the result depends , he says, entirely upon inherent muscle strength as it is not possible to go bankrupt for oxygen in a brief time.

READING REFERENCES- Bagby, English. The psychological effects of oxygen depreciation. Journal of Comparative Psychology. 1:1, February, 1921.

FEWER QUAKES THAN AVERAGE IN 1922

Eighty-four earthquakes strong enough to be felt by the unaided senses were reported in the continental United States during the year 1922, according to the annual summary issued by the U. S. Weather Bureau. The number was somewhat below the average. Nineteen of the quakes were of more than slight intensity but none caused more than slight damage.

Although localities in twenty states experienced shocks, the great majority were located either in California or in the neighborhood of the junction of the Ohio and the Mississippi rivers, the number of places reporting earthquakes being about the same in the two regions. Shocks were also felt at widely separated points in New England, New York, the Southern Appalachian region, the Lake region, and the northern Rocky Mountain states.

The region around the junction of the Ohio and Mississippi rivers is one of the principal earthquake sections of the continent. It was the center of what is described by experts as probably the most severe earthquake which has occurred within

the limits of the United States since the days of the settlement. This was the famous New Madrid earthquake which took place about 112 years ago and was felt all through the middle Mississippi and lower Missouri and Ohio valleys.

Severe earthquakes are known to have occurred in New England during colonial times but none of any great intensity has been experienced since.

SAMPLES OF HAFNIUM COMING TO AMERICA

Samples of minerals and concentrated preparations containing Hafnium, the new chemical element discovered by Drs. G. Hevesy and D. Coster of the Institute of Theoretical Physics, Copenhagen, are en route to this country for examination by chemists here. The samples have been dispatched by Dr. Hevesy to Dr. George F. Kunz, president of the New York Mineralogical Club and are expected here shortly.

Hafnium is believed by Dr. Hevesy to be the hitherto missing or undiscovered element No. 72, and to be altogether a different substance from Celtium, detected in 1911 by the French chemist, Urbain, who thought it was element No. 72, but classed it with the "rare earths".

In a letter to Dr. Kunz, Dr. Hevesy indicated that a new atomic weight value for zirconium, the metal with which hafnium was found, may be a by-product of the discovery.

"Virtually all commercially pure preparations of zirconium contain from one to five per cent. of hafnium, " said Dr. Hevesy. Since hafnium has an atomic weight greater than zirconium, it is believed that the present accepted value for zirconium is too high.

In explaining why hafnium fits into the vacant niche in the chemical table better than Urbain's celtium, Dr. Hevesy's letter explained that hafnium's chemical properties place it in the class of elements that include zirconium and thorium, and that "it has not been possible by means of highly concentrated Hafnium preparations to reproduce the characteristic optical spectrum ascribed by Urbain to Celtium, and which, together with an investigation of the magnetic properties of his preparation, was the basis of the announcement of the discovery of this element."

HYDROGEN FROZEN AT BUREAU OF STANDARDS

Persons looking for a cool place to spend the coming summer might profit by a consultation with some of the low temperature experts at the Bureau of Standards who have announced the freezing of 100 cubic centimeters or about a winglass full of liquid hydrogen, at a temperature of 437 below zero Fahrenheit. It was frozen from about a liter of the liquefied hydrogen, approximately a quart in common measure. This is the first time solid hydrogen has been produced at the Bureau of Standards.

Although hydrogen was first liquefied by Dewar, the British scientist, about 25 years ago, the experiment has not been repeated successfully more than a dozen times since. It presents great difficulties, absolute purity of the gas is necessary. A small fraction of one per cent. of air, for example, will freeze solid and clog up the apparatus.

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An experiment in language study conducted with 300 girls has showed that an artificial language can be learned more easily than a natural language. The large volunteer class of Wellesley College students has just completed a course in which Prof. Christian A. Ruckmick taught them Danish and Esperanto at the same time. Esperanto, the proposed artificial international auxiliary language was mastered more quickly than the tongue of the Danes.

The two languages were given an equal chance during the six weeks course which was conducted under the department of psychology. Announcements of the course were hyphenated "Danish-Esperanto". The alphabets of both languages were given at the first class meeting and an equal review was held just before the double examination which was used in judging the relative ease of acquiring the two languages. The textbooks used were elementary and no home study was allowed. The books were locked up between classes.

"Even when the students missed some of the Esperanto classes they did better in Esperanto than in Danish," said Dr. Ruckmick. A partial grading of students present at all classes showed the following numerical score: Esperanto, 58.540; Danish, 45.924. Although there was no examination in pronunciation, Dr. Ruckmick believes that the students found Esperanto easier to speak. More ground was covered in the Esperanto lessons and this made the examination in the artificial tongue harder, although no allowance for this was made in the ratings. The linguistic experiments are being continued this semester.

Danish was selected for comparison with Esperanto in the scientific tests, Dr. Ruckmick said, because it is a typical highly-inflected Teutonic language in which the students had practically no grounding.

The Wellesley tests are being followed with interest by the International Auxiliary Language Committee of the International Research Council, as well as the newly organized section on Linguistic Science of the American Association for the Advancement of Science.

MASTODONS AND MAMMOTHS ONCE PLENTIFUL IN NEW YORK

Mastodons and wooly mammoths were once as thick in New York State as the bison were on the western plains a century ago, according to Dr. Sherman C. Bishop, zoologist of the State Museum of New York. Although the mammoths were more closely related to the elephants, the only surviving members of the family, they were the first to become extinct and probably passed off the scene while the mastodons were still thriving.

Skeletons of mastodons, more or less complete, and some of them suitable for museum mounting, have been found in about 100 localities in the state, the last one at Temple Hill, Orange County, in 1921. The first was made in Columbia county, not far from Albany, in 1705.

These huge mammals are believed to have flourished about the end of the last glacial period, some 20,000 years ago. Their skeletons are found generally in the marsh lands of those early days. ----------

READING REFERENCE- Neuville, Henri. On the extinction of the mammoth. Smithsonian Institution annual report 1919. Washington, 1921. Lucas, F. A. Animals of the past. New York. American Museum of Natural History, 1922. Hutchinson, H. N. Extinct monsters and creatures of other days; a popular account of some of the larger forms of ancient life. New York., D. Appleton & Company, 1915.

OXYGEN GLUTTONS MAKE GOOD ATHLETES

Possibilities of athletic records of an entirely new sort are disclosed by Dr. A. V. Hill, professor of physiology in the University of Manchester, England, who proposes competitive measurements of the oxygen-using qualities of athletes, the man who absorbs most to get the prize. He also suggests tests of the amount of "credit" on oxygen which nature permits individual athletes.

Aside from the inherent strength of the muscles and the psychological quality of stamina, Dr. Hill believes the power of an athlete to depend largely upon his capacity to use oxygen quickly and upon the tolerance of his body for lactic acid, a waste product of muscular exertion which is rapidly oxidized upon the completion of the effort. This is measured by the amount of oxygen consumed immediately after the completion of the effort, the increased consumption being considered as the payment by nature of a "loan" made to the body during the period of severe exertion.

A professor in the University holds the record for oxygen consumption during exertion, having managed to utilize more than four liters, or a gallon, a minute while running vigorously. Dr. Hill calculates that to do this he had to pump all the blood in his body through his heart and lungs seven times in a minute. Another member of the faculty at the completion of violent exercise lasting 10 minutes, utilized in the next 10 minutes 10 liters of oxygen above the normal. This indicates according to Dr. Hill that he had about the maximum amount of lactic acid in his muscles or that his "line of credit" in oxygen was exceedingly good, his system putting up for a time with the lack of a great deal of it.

Dr. Hill surmises on the basis of these calculations that the maximum athletic records involving prolonged exertion may be calculated mathematically. For brief efforts the result depends , he says, entirely upon inherent muscle strength as it is not possible to go bankrupt for oxygen in a brief time.

READING REFERENCES- Bagby, English. The psychological effects of oxygen depreciation. Journal of Comparative Psychology. 1:1, February, 1921.

FEWER QUAKES THAN AVERAGE IN 1922

Eighty-four earthquakes strong enough to be felt by the unaided senses were reported in the continental United States during the year 1922, according to the annual summary issued by the U. S. Weather Bureau. The number was somewhat below the average. Nineteen of the quakes were of more than slight intensity but none caused more than slight damage.

Although localities in twenty states experienced shocks, the great majority were located either in California or in the neighborhood of the junction of the Ohio and the Mississippi rivers, the number of places reporting earthquakes being about the same in the two regions. Shocks were also felt at widely separated points in New England, New York, the Southern Appalachian region, the Lake region, and the northern Rocky Mountain states.

The region around the junction of the Ohio and Mississippi rivers is one of the principal earthquake sections of the continent. It was the center of what is described by experts as probably the most severe earthquake which has occurred within

the limits of the United States since the days of the settlement. This was the famous New Madrid earthquake which took place about 112 years ago and was felt all through the middle Mississippi and lower Missouri and Ohio valleys.

Severe earthquakes are known to have occurred in New England during colonial times but none of any great intensity has been experienced since.

SAMPLES OF HAFNIUM COMING TO AMERICA

Samples of minerals and concentrated preparations containing Hafnium, the new chemical element discovered by Drs. G. Hevesy and D. Coster of the Institute of Theoretical Physics, Copenhagen, are en route to this country for examination by chemists here. The samples have been dispatched by Dr. Hevesy to Dr. George F. Kunz, president of the New York Mineralogical Club and are expected here shortly.

Hafnium is believed by Dr. Hevesy to be the hitherto missing or undiscovered element No. 72, and to be altogether a different substance from Celtium, detected in 1911 by the French chemist, Urbain, who thought it was element No. 72, but classed it with the "rare earths".

In a letter to Dr. Kunz, Dr. Hevesy indicated that a new atomic weight value for zirconium, the metal with which hafnium was found, may be a by-product of the discovery.

"Virtually all commercially pure preparations of zirconium contain from one to five per cent. of hafnium, " said Dr. Hevesy. Since hafnium has an atomic weight greater than zirconium, it is believed that the present accepted value for zirconium is too high.

In explaining why hafnium fits into the vacant niche in the chemical table better than Urbain's celtium, Dr. Hevesy's letter explained that hafnium's chemical properties place it in the class of elements that include zirconium and thorium, and that "it has not been possible by means of highly concentrated Hafnium preparations to reproduce the characteristic optical spectrum ascribed by Urbain to Celtium, and which, together with an investigation of the magnetic properties of his preparation, was the basis of the announcement of the discovery of this element."

HYDROGEN FROZEN AT BUREAU OF STANDARDS

Persons looking for a cool place to spend the coming summer might profit by a consultation with some of the low temperature experts at the Bureau of Standards who have announced the freezing of 100 cubic centimeters or about a wineglass full of liquid hydrogen, at a temperature of 437 below zero Fahrenheit. It was frozen from about a liter of the liquefied hydrogen, approximately a quart in common measure. This is the first time solid hydrogen has been produced at the Bureau of Standards.

Although hydrogen was first liquefied by Dewar, the British scientist, about 25 years ago, the experiment has not been repeated successfully more than a dozen times since. It presents great difficulties, absolute purity of the gas is necessary. A small fraction of one per cent. of air, for example, will freeze solid and clog up the apparatus.

Using a special multiple wall vacuum container, designed by Dr. C. W. Kanolt in charge of low temperature work, it has been found possible to preserve liquid hydrogen for a much longer period than with the older forms.

The degree of cold produced is inconceivable to the non-technical mind, the coldest temperature on the earth's surface ever recorded having been only 90 below zero, recorded in Siberia, while temperatures as low as 70 are rarely experienced.

Solid hydrogen melts at a temperature of about 435 degrees below zero Fahrenheit. This is only about 25 degrees above the "absolute zero", where there is no heat left. Solid hydrogen has been used in trying to approach this goal which scientists believe will never be quite reached. Experiments at these extremely low temperatures have a bearing on theories as to the ultimate constitution of matter, which is one of the great problems of modern science.

READING REFERENCES- Taylor, Hugh S. Industrial hydrogen. New York. Chemical Catalogue Company, Inc. 1921.

NEW JERSEY BOY WINS HOOVER RADIO CUP

The highest honor in amateur radio, the Hoover cup of the American Radio Relay League was awarded this year to station 20M operated by Frederick B. Ostman, of Ridgwood, N. J. Announcement of the award was made at the League headquarters in Hartford by a committee of three judges selected by Hiram Percy Maxim, president.

The cup, which is awarded annually by the U. S. Department of Commerce through Secretary Hoover, is given to the best all around radio station, the major part of the equipment bf which is home-made. Important factors in its selection are ingenuity in design, construction and arrangement, efficiency, consistent transmitting range, obedience to regulations, amount of traffic handled, and the accuracy and completeness of the station log.

In making the award, two other stations were given special consideration, "FZ, operated by F. Frimmerman of 740 Prospect Ave., New York City, and 5ZA, operated by Louis Falconi, Roswell, N. M., winner of the cup last year.

EEECTRICAL INSTRUMENT DETECTS METAL DEPOSITS

The old time magic divining rod used in the search for subterranean treasures has been succeeded by a reliable and accurate electrical set of instruments invented in Sweden, and used in the recent discoveries of valuable mineral deposits.

The discovery of the rich copper deposits in the Bjurfors field in Central Sweden, already announced, and of the huge iron ore deposits at Kristineberg, which has an estimated capacity of 100,000 tons of high class ore annually, is definite proof of what can be done by this new system. The invention has been definitely adopted by the Government Research Department, whose head, Axel Gavelin, hails it as of extreme importance to the continued development of Sweden's ancient mining industry.

The perfected system of detecting ore by the use of electricity, and without digging or drilling, has been called the Nathorst-Lundberg method, from the names of the Swedish inventors, who have triumphed after years of experimenting. By this

system, which makes use of an electric circuit through linear electrodes, it is possible to locate deposits of iron, copper, lead, zinc, and even gold, and to determine their position, length, breadth, and general richness, though it may not distinguish between the metals.

This method which has been used successfully in Norway and Finland, as well as in Sweden, has been introduced in France and Italy, and has been patented in at least 30 countries.

TABLOID BOOK REVIEW

THE PLEISTOCENE OF NORTH AMERICA AND ITS VERTEBRATED ANIMALS FROM THE STATES EAST OF THE MISSISSIPPI RIVER AND FROM THE CANADIAN PROVINCES EAST OF LONGITUDE 95 DEGREES, By Oliver P. Hay, Associate of the Carnegie Institution of Washington. Published by the Carnegie Institution of Washington, Washington, February 1923.

A complete survey of the finds of mammalian fossils of the great Ice Ages, is included in this work which also supplies maps showing the distribution of the various elephants, camels, horses, and other forms not found living here at the time of the advent of white men to this continent. The author concludes from the mass of data which he has collected that the Pleistocene was a period of slight, if any, evolution of new forms, but that its five alternate periods of advancing and retreating ice sheets resulted in a progressive extermination of many species. This is an invaluable reference book for the vertebrate palaeontologist.

STUDIES IN PLANT RESPIRATION AND PHOTOSYNTHESIS, By H. A. Spoehr and J. M. McGee. Published by the Carnegie Institution of Washington. February, 1923.

The old problem of how to use sun power has been worked on by the Carnegie Institution's laboratories in Tucson, Arizona and Carmel, Calif., for the last eight years. These scientists have been studying the only successful converter of solar energy, the green pigmented living plant, in an endeavor to discover the secret of its process. This book is a technical presentation of the results of that study and the methods being used in it, as well as a statement of the problem and a review of the work done by others toward its solution.

The resurrection fern of our Southern States, a plant which remains in a state of suspended animation during drouth, has been known to survive for more than a year without water.

Glasgow, Scotland, was miles away from its port on a shallow stream two feet deep, when in 1773 engineers narrowed the channel and made the river dig its own bottom deeper so that now huge ocean liners can dock.

Rubber obtained from trees which grow wild in Brazil is superior in quality to that obtained from the same sort of trees under cultivation.

It has been discovered that the kind of dates grown within sight of the Great Pyramids of Egypt is well adapted to production in southern California on a commercial scale.

Thousands of years before the invention of cotton machinery in Europe, Hindus had cotton gins, spinning wheels, and looms.
